Elephant Toothpaste

Decomposition Reactions

Introduction

Mix together hydrogen peroxide, sodium iodide solution, and dishwashing liquid in a tall cylinder and stand back. Your students will observe with amazement a catalyst in action as an enormous amount of soapy foam erupts from "Old Foamey!"

Concepts

- Catalysts
- Decomposition Reactions

Materials

Hydrogen peroxide, 30%, 20 mL
Sodium iodide solution, 2 M, 5 mL
Dishwashing liquid, 10 mL
Food coloring (optional)
Graduated cylinder, 10-mL
Graduated cylinder, 100-mL
Plastic tray, several inches deep

Safety Precautions

Hydrogen peroxide, 30% will act as an oxidizing agent with practically any substance. This substance is severely corrosive to the skin, eyes, and respiratory tract; a very strong oxidant; and a dangerous fire and explosion risk. Do not heat this substance. Sodium iodide is slightly toxic by ingestion. Although the dishwashing liquid is considered non-hazardous, do not ingest the material. Do not stand over the reaction; steam and oxygen are produced quickly. Wear appropriate chemical splash goggles, chemical-resistant gloves and a chemical-resistant apron. This activity requires the use of hazardous components and/or has the potential for hazardous reactions. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Place a 100-mL graduated cylinder in a plastic tray that is several inches deep.
2. Measure out 20 mL of the 30% hydrogen peroxide into the 100-mL graduated cylinder. *Caution:* Wear chemical resistant gloves and goggles when handling 30% hydrogen peroxide. Contact with skin may cause burns.
3. Measure out 10 mL of dishwashing liquid into the 10-mL graduated cylinder and add it to the cylinder containing the hydrogen peroxide. Add a few drops of food coloring, if desired. Have your students observe that little or no reaction occurs.
4. Measure out 5 mL of sodium iodide solution using the 10-mL graduated cylinder. Quickly but carefully, add the sodium iodide solution to the 100-mL graduated cylinder.
5. Step back and observe the reaction.

Disposal

The foam and solution left in the cylinder may be rinsed down the drain with excess water. Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste.

Publication No. 91098
031617

Tips

- You may want to do this demonstration in the laboratory sink since there is a lot of foam produced. Cleanup, however, is easy due to the presence of extremely safe products and the generous amount of detergent.
- The cylinder will get hot, so let it cool before handling.
- This demonstration can be easily and safely scaled up for larger audiences. A 500-mL or 1-L Pyrex® graduated cylinder works well in this case.
- The slight brown tinge of the foam at the beginning is due to the presence of free iodine produced by the extreme oxidizing ability of the 30% hydrogen peroxide.
- Another catalyst that will catalyze this reaction is manganese(IV) oxide, MnO_2.
- To demonstrate that oxygen is indeed one of the products, light a match and blow it out. Ideally, the center of the match will still be orange. Hold the match very close to the foam produced—the match should reignite.

Discussion

This demonstration evolves a good deal of heat as shown by the steam coming off of the foam as it is produced. The reaction, therefore, is exothermic. The action of a catalyst is demonstrated. The catalyst is the $I^-(aq)$ ion which speeds up the decomposition of the hydrogen peroxide. The decomposition of hydrogen peroxide produces steam and oxygen gas. The oxygen gas and water vapor cause the dishwashing liquid to foam.

$$2H_2O_2(aq) \xrightarrow{I^-(aq)} 2H_2O(g) + O_2(g) + \text{Energy}$$

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation

Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter, chemical reactions, interactions of energy and matter

Acknowledgement

Special thanks to Jim and Julie Ealy of The Peddie School in Hightstown, NJ.

Reference

Stone, C. H. J. Chem. Ed. 1944, 21, 300.

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Elephant Toothpaste* activity, presented by DeWayne Leineman, is available in *Decomposition Reactions*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Elephant Toothpaste* are available from Flinn Scientific, Inc.

Materials required to perform this activity are available in the *Old Foamey—Chemical Demonstration Kit* available from Flinn Scientific. Materials may also be purchased separately.

Catalog No.	Description
AP2085	Old Foamey—Chemical Demonstration Kit
H0037	Hydrogen Peroxide, 30%, 100 mL
S0436	Sodium Iodide, 100 g
C0241	Cleaner, Liquid, Household-Type
V0003	Food Coloring Dyes, Set of 4
AP5429	Demonstration Tray, Large

Consult the Flinn Scientific website for current prices.